

Serial No. 10/049,875

IN THE CLAIMS:

1. (currently amended) ~~A heat-treated silicon wafer for non-oxidative heat treatment for use in semiconductor device manufacture, wherein the silicon wafer is obtained by slicing a silicon wafer from a silicon ingot being prepared by a Czochralski method or a MCZ method, wherein the sliced silicon wafer has a V-rich region, an L-rich region, a nitrogen concentration is in the range from 5×10^{13} atoms/cm³ to 1×10^{15} atoms/cm³ and includes void defects; and wherein the heat-treated silicon wafer is prepared by heat-treating the sliced silicon wafer under a non-oxidative atmosphere such that the void defects of a wafer surface layer thereof are reduced.~~

2. (currently amended) A silicon wafer for non-oxidative heat treatment for use in semiconductor device manufacture, wherein the silicon wafer is obtained from a silicon ingot being prepared by a Czochralski method or a MCZ method with $V/G1$ higher than $0.18 \text{ mm}^2 / ^\circ\text{C min}$ and not exceeding $0.4 \text{ mm}^2 / ^\circ\text{C min}$ where V is a pulling speed and $G1$ is a temperature gradient in a vicinity of a solid/liquid interface, and wherein the silicon wafer contains nitrogen concentration is in the range from 5×10^{13} atoms/cm³ to 4×10^{14} atoms/cm³.

3. (currently amended) ~~A~~The heat-treated silicon wafer for non-oxidative heat treatment for use in semiconductor device manufacture according to claim 1, wherein the silicon wafer is a silicon wafer for hydrogen heat-treated treatment or a silicon wafer for under a hydrogen atmosphere, an argon atmosphere, annealing or a combination thereof.

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4. (currently amended) A method of manufacturing a silicon ingot for manufacturing of silicon wafers for non-oxidative heat treatment, the method comprising: wherein a method of manufacturing a silicon ingot by pulling a silicon single crystal by a Czochralski method or a MCZ method to manufacture the silicon ingot, wherein nitrogen is doped and the silicon single crystal is pulled under a conditions that a portion of the silicon single crystal is formed in which nitrogen concentration is from 5×10^{13} atoms/cm³ to 1×10^{15} atoms/cm³ and that $V/G1$ is higher than $0.18 \text{ mm}^2 / ^\circ\text{C min}$ and not exceeding $0.4 \text{ mm}^2 / ^\circ\text{C min}$ where V is a pulling speed and $G1$ is a temperature gradient in a vicinity of a solid/liquid interface.

5. (currently amended) A The silicon wafer for manufacturing a semiconductor device manufactured by hydrogen heat treatment or argon annealing of the silicon wafer for non-oxidative heat treatment according to claim 12, wherein the silicon wafer is for heat treatment under a hydrogen atmosphere, an argon atmosphere, or a combination thereof.

6. (currently amended) A silicon wafer for semiconductor device manufacture, having $3 \mu\text{m}$ of a surface layer removed wherein a doping amount of nitrogen thereof is adjusted taking into account life of a virtual element determined such that an annealed silicon wafer achieves a predetermined oxide film withstand voltage non-defective ration with TZDB test after said removal of a surface layer of $3 \mu\text{m}$.

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7. (currently amended) A method of evaluating determination of a doping nitrogen-concentration doped of a silicon wafer wherein decision as to whether or not the nitrogen-doped wafer can be used as a wafer for semiconductor device manufacture is made by calculating life of a virtual element on a nitrogen-doped heat treatment wafer comprising:

heat-treating a silicon wafer doped with nitrogen under non-oxidative atmosphere such that void defects of a surface layer are reduced so as to obtain the nitrogen-doped silicon wafer;

removing the surface layer from the nitrogen-doped silicon wafer; and
conducting a TDDB or a TZDB test for the nitrogen-doped silicon wafer.

8. (currently amended) The method of evaluating wafers according to claim 7, wherein the method of calculating the life of the virtual element on the wafer is the TDDB test determines an upper limit of the nitrogen concentration.

9. (new) The heat-treated silicon wafer according to claim 1, wherein the nitrogen concentration is in a range from 5×10^{13} atoms / cm^3 to 4×10^{14} atoms / cm^3 .

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10. (new) The heat-treated silicon wafer according to claim 1, wherein the nitrogen concentration is in a range from 1×10^{14} atoms / cm^3 to 4×10^{14} atoms / cm^3 .

11. (new) The heat-treated silicon wafer according to claim 1, wherein the silicon ingot is prepared by a Czochralski method or a MCZ method with $V/G1$ higher than $0.18 \text{ mm}^2 / ^\circ\text{C min}$ and not exceeding $0.4 \text{ mm}^2 / ^\circ\text{C min}$ where V is a pulling speed and $G1$ is a temperature gradient in a vicinity of a solid/liquid interface.

12. (new) The heat-treated silicon wafer according to claim 9, wherein the silicon ingot is prepared by a Czochralski method or a MCZ method with $V/G1$ higher than $0.18 \text{ mm}^2 / ^\circ\text{C min}$ and not exceeding $0.4 \text{ mm}^2 / ^\circ\text{C min}$ where V is a pulling speed and $G1$ is a temperature gradient in a vicinity of a solid/liquid interface.

13. (new) The heat-treated silicon wafer according to claim 10, wherein the silicon ingot is prepared by a Czochralski method or a MCZ method with $V/G1$ higher than $0.18 \text{ mm}^2 / ^\circ\text{C min}$ and not exceeding $0.4 \text{ mm}^2 / ^\circ\text{C min}$ where V is a pulling speed and $G1$ is a temperature gradient in a vicinity of a solid/liquid interface.

14. (new) The heat-treated silicon wafer according to claim 1, wherein the heat treatment is under a hydrogen atmosphere, an argon atmosphere, or a combination thereof.